Issued 14 January 2000

English Nature's advice for the Flamborough Head European marine site given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994.

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Preface

This document provides English Nature's advice to other relevant authorities as to (a) the conservation objectives, and (b) any operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species for the Flamborough Head European marine site. This advice is being prepared to fulfill our obligations under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994.

The Flamborough Head European marine site is part of a candidate Special Area of Conservation. It is Government policy that such sites should be protected as if they were already designated and, where appropriate, it is desirable to establish voluntary management schemes at an early stage, before the formal statutory obligations apply, and to act in the spirit of the Directive in the meantime (DETR & The Welsh Office 1998). In light of this policy, we have worked with many of you to develop this advice in advance of statutory obligations applying.

European marine sites are defined in the Conservation (Natural Habitats &c.) Regulations 1994 as any part of a European site covered (continuously or intermittently) by tidal waters or any part of the sea in or adjacent to Great Britain up to the seaward limit of territorial waters. European sites include Special Areas of Conservation under the Habitats Directive, which support certain natural habitats and species of European importance, and Special Protection Areas under the Birds Directive which support significant numbers of internationally important wild birds.

This 'Regulation 33 package' is designed to help relevant and competent authorities, who have responsibilities to implement the Habitats Directive, to:

- understand the international importance of the site, underlying physical processes and the ecological requirements of the habitats and species involved;

- develop a management scheme to ensure that the ecological requirements of the site's interest features are met; and

- set the standards against which the condition of the site's interest features can be determined and compliance monitoring undertaken to establish whether they are in favourable condition.

In addition, the Regulation 33 package will provide a basis to inform the scope and nature of 'appropriate assessment' required in relation to plans and projects (Regulations 48 & 50 and by English Nature under Regulation 20). English Nature will keep this advice under review and may update it every six years or sooner, depending on the changing circumstances of the European marine site. In addition, we will provide more detailed advice to competent and relevant authorities to assess the implications of any given plan or project under the Regulations, where appropriate, at the time a plan or project is being considered. If during the European Union's moderation process qualifying interest features are added to this European marine site, English Nature will add to this advice, as appropriate.

Tim Bines
English Nature
14 January 2000

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1. Introduction

1.1 Natura 2000

The European Union Habitats[1] and Birds[2] Directives are international agreements which set out a number of actions to be taken for nature conservation. The Habitats Directive aims to promote the maintenance of biodiversity, taking account of economic, social, cultural and regional requirements, and sets out measures to maintain or restore, natural habitats and species of European Union interest at favourable conservation status[3]. The Birds Directive protects all wild birds and their habitats within the European Union, especially migratory birds and those that are considered rare or vulnerable.

The Habitats and Birds Directives include requirements for the designation of conservation areas. In the case of the Habitats Directive these are Special Areas of Conservation (SACs) which support certain natural habitats or species, and in the Birds Directive, Special Protection Areas (SPAs) which support wild birds of European Union interest. These sites will form a network of conservation areas to be known as "Natura 2000". Where SACs or SPAs consist of areas continuously or intermittently covered by tidal waters or any part of the sea in or adjacent to Great Britain up to the limit of territorial waters, they are referred to as European marine sites.

Further guidance on European marine sites is contained in the Department of the Environment Transport and Regions/Welsh Office document: *European marine sites in England & Wales: A guide to the Conservation (Natural Habitats &c.) Regulations 1994 and to the preparation and application of management schemes.*

1.2 English Nature's role

The Conservation (Natural Habitats &c.) Regulations 1994 translate the Habitats Directive into law in Great Britain. It gives English Nature a statutory responsibility to advise relevant authorities as to the conservation objectives for European marine sites in England and to advise relevant authorities as to any operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species for which the sites have been designated. This information will be a key component of any of the management schemes which may be developed for these sites.

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[1] Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora

[2] Council Directive 79/409/EEC on the conservation of wild birds

[3] A habitat or species is defined as being at favourable conservation status when its natural range and the areas it covers within that range are stable or increasing and the specific structure and functions which are necessary for its long term maintenance exist and are likely to continue to exist for the foreseeable future.

This document is English Nature's advice for the Flamborough Head European marine site issued in fulfilment of Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994 (the 'Regulation 33 package'). Copies of key references quoted in this document are held at the English Nature local office. In addition to providing such advice, the Regulation 33 package will inform the scope and nature of 'appropriate assessment' which the Directive requires to be undertaken for plans and projects (Regulations 48 & 50 and by English Nature under Regulation 20). In the future, English Nature may also provide more detailed advice to competent and relevant authorities to assess the implications of any such plans or projects.

1.3 The role of relevant authorities

The Conservation (Natural Habitats &c.) Regulations 1994 require relevant authorities to exercise their functions so as to secure compliance with the Habitats Directive. The management scheme which the relevant authorities are drawing up under Regulation 34 for the Flamborough Head European marine site will provide the framework through which this will be done and it should be based on the advice in this package. In this respect, relevant authorities must, within their areas of jurisdiction, have regard to both direct and indirect effects on an interest feature of the site. This may include consideration of issues outside the boundary of the European marine site.

Relevant authorities should ensure that all plans for the area integrate with the management scheme for the European marine site. Such plans may include Shoreline Management Plans, Local Environment Agency Plans, SSSI management plans, local Biodiversity Action Plans and sustainable development strategies. This must occur to ensure that there is only a single management scheme through which all relevant authorities exercise their duties under the Conservation (Natural Habitats &c.) Regulations 1994.

Relevant authorities also need to have regard to changing circumstances of the SAC and SPA and may therefore need to modify the management scheme and/or the way in which they exercise their functions so as to maintain the favourable condition of interest features concerned in the long term. There is no requirement for relevant authorities to take any actions outside their statutory functions.

Under certain circumstances, where another relevant authority is unable to act for legal reasons, or where there is no other relevant authority, English Nature is empowered to use its byelaw-making powers for Marine Nature Reserves (MNR) for use in European marine sites.

1.4 Activity outside the control of relevant authorities

Nothing within this Regulation 33 package will require relevant authorities to undertake any actions or ameliorate changes in the condition of interest features if it is shown that the changes result wholly from natural causes[4]. This also applies if the changes, although causing deterioration or disturbance to the interest features, are the result of human or natural events outside their control. Having issued Regulation 33 advice for European marine sites, English Nature will work with relevant authorities and others to agree, within a defined time frame, a protocol for evaluating all observed changes to baselines and to develop an understanding of natural change and provide further guidance as appropriate and possible.

[4]Determination of what constitutes natural change will be based on the best available information and scientific opinion at the time.

On the Flamborough Head European marine site a SAC Management Group, consisting of relevant authorities (Appendix I), and an advisory group, the Flamborough Head Maritime Forum consisting of interest groups, have already been set up and should be used to alert English Nature to such issues so that they may be assessed and any appropriate measures taken. This does not, however, preclude relevant authorities from taking action to prevent deterioration to the interest features, for example by introducing or promoting codes of practice through the Management Group.

1.5 Responsibilities under other conservation designations

In addition to its candidate SAC status and SPA status, parts of Flamborough Head are also designated and subject to agreements under other conservation legislation (e.g. SSSIs notified under the Wildlife and Countryside Act 1981, as amended 1985). The obligation of relevant authorities and other organisations under such designations are not affected by the advice contained in this document.

1.6 Role of conservation objectives

Section 4 of this document sets out the conservation objectives for the Flamborough Head European marine site. They are the starting point from which management schemes and monitoring programmes are to be developed as they provide the basis for determining what is likely to cause a significant effect, and for informing on the scope of appropriate assessments of plans or projects. The conservation objectives set out what needs to be achieved and thus deliver the aims of the Habitats Directive**.**

1.7 Role of advice on operations

The advice on operations set out in Section 6 provides the basis for discussion about the nature and extent of the operations taking place within or close to the site and which may have an impact on its interest features. It is given on the basis of the working assumption that sites have been generally presumed to have been in favourable condition at the time they were identified. This assumption will be tested during the 2000 - 2006 reporting period. The advice should also be used to identify the extent to which existing measures of control, management and use are, or can be made, consistent with the conservation objectives and thereby focus the attention of relevant authorities and surveillance to areas that may need management measures.

This operations advice, when issued, will need to be supplemented through further detailed discussions with the management and advisory groups in formulating and agreeing a management scheme, where required, to agreed timescales for the European marine site.

2. Identification of interest features under the EU Habitats and Birds Directives

2.1 Introduction

Flamborough Head is a candidate Special Area of Conservation (SAC) and Flamborough Head and Bempton Cliffs is a Special Protection Area (SPA). The boundaries of these two sites are illustrated in Appendix II.a and II.b respectively. The marine components of both sites qualify as European marine sites, as defined by the Regulations. Accordingly, the advice in this document covers only the habitats and species, within the boundary of the Flamborough Head European marine site (Figure 1).

Where the habitats and species occur within the European marine site they are referred to as interest features. Sub-features have also been identified to highlight the ecologically important components of each interest feature. The interest features and sub-features for the Flamborough Head European marine site are discussed in Section 3 in more detail and are mapped at Figures 2 and 3 to show their distribution and extent. The boundary of the Flamborough Head European marine site is illustrated in Figure 1.

2.2 Interest features under the EU Habitats Directive

Flamborough Head qualifies as a candidate SAC for the following Annex I habitats as listed in the EU Habitats Directive:

- **Reefs**
- **Submerged or partially submerged sea caves**

The Flamborough Head SAC also qualifies for the Annex I habitat **vegetated sea cliffs of the Atlantic and Baltic coasts**. This does not however, occur within the European marine site, and therefore within this document, as it occurs above Highest Astronomical Tide. Objectives to maintain vegetated sea cliffs in favourable condition are found within English Nature's conservation objectives for the relevant SSSI within the SAC boundary and will be dealt with through procedures outlined in the Conservation (Natural Habitats &c.) Regulations 1994. Relevant authorities will need to have regard to such adjacent European interests within the management scheme for the European marine site, as they might be affected by activities taking place within, or adjacent to the European marine site.

2.3 Interest features under the EU Birds Directive

Flamborough Head and Bempton Cliffs qualifies as a SPA for its internationally important breeding population of kittiwake *Rissa tridactyla* and nationally important breeding populations of guillemot *Uria aalge*, razorbill *Alca torda* and puffin *Fratercula arctica* which nest on the cliffs. The habitat required for these species to nest does not however, occur within the European marine site as it occurs above Highest Astronomical Tide. Objectives to maintain the bird interests in favourable condition are found within English Nature's conservation objectives for the relevant SSSI within the SPA boundary and will be dealt with through procedures outlined in the Conservation (Natural Habitats &c.) Regulations 1994. Relevant authorities will however, need to have regard to such adjacent European interests within the management scheme for the European marine site, as they might be affected by activities taking place within, or adjacent to the European marine site.

Fig.1

3. European marine site interest features

The UK has 75% of the chalk reefs in Europe and Flamborough Head accounts for nearly 9% of European coastal chalk exposure (English Nature 1994). Flamborough Head also represents the most northerly outcrop of coastal chalk in the UK and the most southerly area of extensive bedrock in the North Sea. The site is characterised by high chalk cliffs (covering a distance of about 16 km), over 200 caves and numerous stack and arch formations. Rich communities of seaweeds and invertebrates occur on these shores and on the chalk reefs offshore, some of them not found on similar chalk sites elsewhere in England. The area is exceptional in the distance that the chalk is found offshore. Flamborough Head is also located close to the biogeographical boundary between two North Sea water bodies and it supports a wide range of marine species. The qualifying interest features of the Flamborough Head European marine site, the reefs and the sea caves, are described in more detail below.

3.1 Reefs

3.1.1 General description

Reefs are rocky marine habitats or biological concretions that arise from the sea bed (Brown *et al.* 1997). They are generally subtidal but may extend as an unbroken transition into the intertidal zone, where they are exposed to the air at low tide. The types of reef habitat which characterise this interest feature include vertical rock walls, horizontal ledges, broken rock and boulder fields. The species assemblage is characterised by attached algae and invertebrates, usually associated with a range of mobile animals, including invertebrates and fish. The specific communities that occur vary according to a number of factors. Rock type, for example, is particularly important, with distinct communities associated with chalk and limestone rock resulting in a restricted distribution in accordance with the distribution of the rock type. There may be further variety associated with features such as gullies, outcrops and rockpools. The greatest variety of communities is typically found where coastal topography is highly varied, with a wide range of exposures to wave actions and tidal streams.

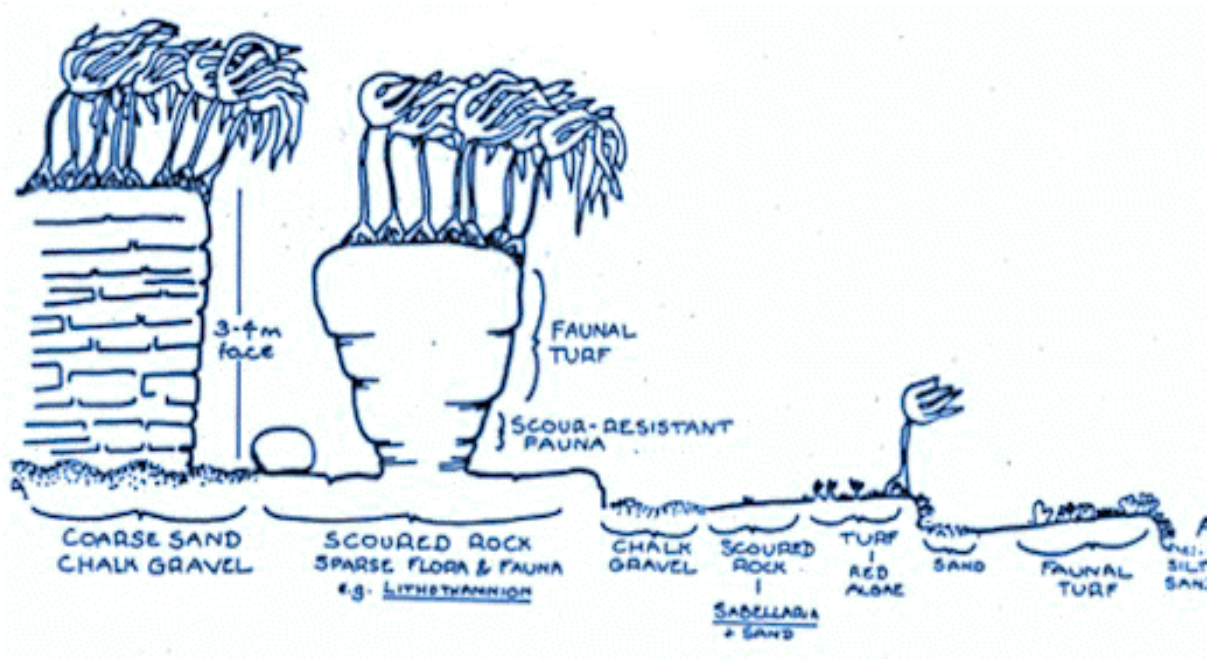
3.1.2 Importance of reefs

The reefs at Flamborough Head are important due to the substrate type, their biogeographic position and the influence of hydrodynamic processes on reef topography and community structure. The chalk reefs at Flamborough Head extend further into deeper water than at other comparable chalk sites in the UK, up to 6 km offshore and into waters 30 m or more in depth (Davies & Sotheran 1995; Brazier *et al.* 1998), giving one of the most extensive areas of sublittoral chalk in Europe (Brown *et al.* 1997). The diversity and composition of biological communities on the reefs around Flamborough Head are a direct result of variation in habitat type and a number of key ecological factors.

Flamborough Head lies at the western end of a recognised boundary between oceanographic cells characterised by a strong offshore frontal system, the ‘Flamborough Front’, which results in a distinct temperature gradient between the waters north and south of the headland (Pingree & Griffiths 1978) . The front is caused by the meeting of colder, deeper, stratified waters of the northern North Sea and warmer, shallower, well-mixed waters of the southern North Sea. The presence of the front contributes to the diverse and unusual range of marine species at Flamborough Head, some of which are at their southern or northern limit of North Sea distribution. Where these two distinct water bodies meet, mixing of the waters leads to increased plankton growth and secondary productivity (Institute of Estuarine and Coastal Studies 1992).

The wide variety of reef habitats at Flamborough Head is the result of both geological differences between the chalk and the different hydrodynamic regime on the northern and southern sides of the headland.

The reefs on the northern side are harder and slightly more exposed than those on the southern side of the headland and as a result, they support a different range of species. The north and east facing coast is characterised by extensive stepped 'scars' that are dissected to form outcrops and gullies (Figure 4). Compared with the softer chalk on the southern side of the headland, the harder, more erosion resistant nature of the sublittoral chalk on the northern side, has resulted in the presence of many sublittoral



overhangs and vertical faces, uncommon at similar chalk reef sites in the UK.

Figure 4. Sublittoral chalk habitats off the northern side of Flamborough Head (Wood 1988), illustrating the importance of sublittoral topography on community structure

Along the south-facing side of the headland, the intertidal rocky shores are characterised by wide wave-cut platforms where the softer chalk cliffs have been eroded, which are often used by juvenile kittiwake as roosting sites at low tide. In the subtidal, the bedrock is made up of terraces which then grade into patches of boulders and cobbles.

The relatively soft nature of chalk compared with other types of rock, enables some species of animal and plant to bore into it. The presence of these species increases the diversity of the communities found on chalk. Some species are also unique to chalk shores and are consequently rare in England.

3.1.3 Sub-features of reef habitats at Flamborough Head

Rocky shore communities - The rocky shores of Flamborough Head are noted for their high number of intertidal biotopes due to the wide variety of habitats and physical conditions around the headland

(Appendix III; Brazier *et al.* 1998). More than 110 species of seaweed, and over 270 species of invertebrates have been recorded from the rocky shores at Flamborough Head, some notable to this area (George *et al.* 1988). The rich and varied shores are of considerable conservation value since they make a significant contribution to the structure and diversity of the site as a whole. Rocky shores also have an important functional role, forming a link between marine and terrestrial environments.

Wave exposure has a significant structuring effect on the type and distribution of rocky shore communities around the headland. At the highest tidal levels around the headland, green and red microalgal species unique to chalk can be found (Brazier *et al.* 1998), whilst on the more exposed sides to the north and east, there are a number of chalk-boring lichen species, such as *Eugomontia sacculata* (Tittley 1988). Exposed northern and eastern shores of Flamborough Head tend to be dominated by marine animals such as limpets *Patella* spp. and barnacles *Semibalanus balanoides*. The chalk-boring wrinkled rock borer *Hiatella arctica*, the oval piddock *Zirfaea crispata* and worms of the *Polydora* spp. are also commonly found boring into the chalk. The sheltered southern shores, such as at South Landing and Sewerby Rocks, are dominated by the brown algal wracks *Fucus serratus* and *F. vesiculosus* interspersed with smaller green *Enteromorpha* spp. and red algae *Ceramium* spp.

Rockpools, crevices, steps in the rock platforms and boulder communities of the intertidal rocky shores around the headland all enhance the species richness of the site. They provide ideal habitats for *Fucus* spp., red algae *Porphyra* spp., pink coralline crusts, coral weed *Corallina officinalis*, the less common china limpet *Patella ulyssiponensis*, kelps *Laminaria* spp., and shannies *Lipophrys pholis*.

Flamborough Head is important for *Callithamnion sepositum*, an algal species not found further south on the North Sea coast (English Nature 1994), and Sea mare's tail *Halurus equisetifolius*, recorded at South Landing, which is not found further north on the east coast.

Kelp forest communities - Kelp forests are highly productive ecosystems found in the shallow subtidal and are the major primary producers in the coastal waters of the UK. It is estimated that 90% of kelp production enters the detrital food webs of coastal areas, supporting a wide range of habitats in addition to the kelp beds (Birkett *et al.* 1998). Kelp forests are also of considerable conservation value because they harbour a wide variety of plants and animals. For example a single kelp holdfast may be home to several thousand small animals, the stipe may be covered in numerous foliose red algae and invertebrates, whilst the habitat also plays a significant role as a nursery area for a wide variety of species. Other important mobile species also occur in the kelp forests, particularly fish such as the ballan wrasse *Labrus bergylta* and the cuckoo wrasse *Labrus mixtus*. These kelp communities are therefore considered to be key structural and functional components of the reefs at Flamborough Head.

The composition of the kelp forest communities and associated biotopes around Flamborough Head (Appendix III; Brazier *et al.* 1998) varies in response to changes in wave exposure, sublittoral topography and depth. Upward facing outcrops and moderately exposed bedrock on the north and east sides of the headland are dominated by *Laminaria hyperborea* kelp forest with a rich understorey of red algae. The infralittoral on the south side is characterised by kelps *L. hyperborea* and by *L. saccharina* on the seasonally mobile cobbles and boulders, usually with a reduced richness of red algae. At Flamborough Head, the natural turbidity of the water restricts kelp forest communities of *Laminaria* spp. and red algae to a maximum depth of 5-8 m below the lowest tide (Davies & Sotheran 1995). The water clarity influences the depth at which algal species grow in the nearshore, by affecting light availability.

The kelp-dominated infralittoral zone at Flamborough Head is particularly important since major components of the flora, such as the 'northern' species of red seaweeds *Lomentaria clavellosa*, *L.*

orcadensis, *Haraldiophyllum bonnemaisonii*, *Odonthalia dentata* and *Ptilota gunneri*, are not found further south in the North Sea (Brazier *et al.* 1996; English Nature 1994). Several seaweed species also reach their northern limit of distribution on the east coast at Flamborough Head, including the red algae *Schottera nicaensis* and *Calliblepharis ciliata*, and the brown alga *Taonia atomaria* (English Nature 1994). In addition a scarce species of sea squirt, *Perophora listeri* has been recorded on sublittoral rock and boulders amongst the kelp forest at Flamborough Head (Brazier *et al.* 1998).

Fig.2

Subtidal faunal turf communities - 'Faunal turfs' are diverse assemblages of attached animals growing on subtidal hard substrata. They range from low encrusting forms, such as sea mats and sponges, to tall erect forms, such as soft corals and sea fans. These communities also include prominent mobile organisms associated with the attached fauna such as decapod crustaceans, echinoderms, molluscs and fish, which may play important structuring roles in the community (Hartnoll 1998). By definition, faunal turf communities are animal dominated, although there will be foliose and crustose red algae present in the upper regions which overlap with the shallower infralittoral zone. In contrast to intertidal substrata, zonation of subtidal communities is very much broadened and space is less frequently monopolised by single dominant species.

Subtidal faunal turf communities at Flamborough Head make up a significant proportion of the reef resource (Figure 2), extending below 2 m depth (Brazier *et al.* 1998), and are therefore an important component of the reefs. The extent (Davies & Sotheran 1995) and diversity of circalittoral biotopes (Brazier *et al.* 1998) is a result of the hydrographic regime, substrate type and seabed topography.

Flamborough Head is situated in a current-swept area which brings with it a different set of conditions and therefore results in different biota to that of nearby areas that lack such movement. Increased water movement is important for the benthic communities on the reefs at Flamborough Head. It increases the provision of suspended food for filter feeders, contributes to effective larval dispersal/ recruitment of many marine species and limits the settlement of silt, which leads to the clogging of gills and feeding organs from smothering. The relatively soft sublittoral chalk at Flamborough Head also provides a wide variety of habitats, such as vertical faces, overhangs and boulder fields, for marine species to attach or burrow into.

The 'living turf' at Flamborough Head is characterised by molluscs, sea-firs, sea mats, sea squirts and sponges, some of which are fragile or slow growing, as well as numerous mobile species, some of which are commercially important. Some heavily sand-influenced habitats on the north-facing coast have small reefs of the polychaete *Sabellaria spinulosa* tubes constructed out of sand particles on bedrock (Wood 1988). Horse mussel *Modiolus modiolus* and common mussel *Mytilus edulis* beds, to the east of the headland (Brazier *et al.* 1998), are bound together by byssus threads which in turn create specialist habitats for other species to grow on or in.

Flamborough Head represents the northern limit of distribution for both the 'southern' species of ascidian *Archidistoma aggregatum* and yellow sponge *Polymastia boletiformis*, whilst the bottle-brush hydroid *Thuiaria thuja* reaches its southern limit of distribution in England here (Brazier *et al.* 1996). The nationally rare hydroid *Diphasia alata* and the bryozoan *Smittina affinis* have also been recorded at Flamborough Head (Barnes & Robson 1995).

3.2 Sea caves

3.2.1 General description

The UK has the most varied and extensive sea caves on the Atlantic coast of Europe (Brown *et al.* 1997). Sites have been selected to encompass the range of structural and ecological variation of sea caves and cover their geographic range. Cave systems with extensive areas of vertical and overhanging rock, and those that extend deeply into the rock, are likely to support a wider range and higher diversity of plants and animals.

Cave communities vary considerably depending on the structure and extent of the cave system, their degree of submergence and of exposure to scour and surge, and the nature of their geology. Caves can vary in size, from only a few metres to more extensive systems, which may extend hundreds of metres into the rock. There may be tunnels or caverns with one or more entrance, in which the vertical and overhanging rock faces provide the principal marine habitat. Caves are typically colonised by encrusting animal species but may also support shade-tolerant algae near their entrances

Caves in the intertidal and shallow sublittoral are frequently subject to conditions of strong wave surge and scour by coarse sediment. This rapid change in physical conditions from cave entrance to the inner parts of the cave often leads to a marked zonation in the communities present. The type of bedrock in which the cave is formed has a significant influence on its shape and qualities as a substrate for its associated communities.

3.2.2 Importance of sea caves

There are larger numbers and a wider range of cave habitats at Flamborough Head than at any other chalk site in Britain (Brown *et al.* 1997). This site, on the east coast of England, represents caves of the North Sea coast cut into soft rock exposures. There are over 200 caves (Tittley 1988) at Flamborough Head, particularly around the headland and on the north facing cliffs (Figure 3) where weaknesses associated with faulting and jointing in the chalk are exposed to wave action.

The largest caves are known to extend for more than 50 m from their entrance on the coast. The caves at Flamborough Head provide shelter to a variety of bird species, including the internationally important kittiwake.

The chalk rock facilitates the attachment of specialist plant and animal communities, some unique to this substrate, making them of high conservation value due to the rarity of this habitat. The site is important for its specialised encrusting and filamentous algal communities, including abundant *Hildenbrandia rubra*, *Pseudoendoclonium submarinum*, *Sphacelaria nana* and *Waerniellina lucifuga* (George *et al.* 1988).

The variation in cave topography and exposure to physical conditions are key determinants in the distribution and type of cave communities at Flamborough Head. Some of the caves are partly submerged at all stages of the tide, others dry out during low water and some lie above the high water mark but are heavily influenced by wave splash and salt spray from the sea. These intertidal cave communities can be described in two broad categories, the upper zone of the caves being characterised by lichen and specialist algal communities and the lower shore dominated by faunal turf communities.

3.2.3 Sub-features of sea cave habitats at Flamborough Head

Microalgal and lichen communities - These specialist communities are important sub-features of the caves at Flamborough Head because of their rarity. The distribution of these communities and zonation within caves has been described in Tittley (1988), Fowler & Tittley (1993) and Brazier *et al.* (1998). Additional information on these communities has been collected through a detailed sea cave survey

(Howson, in prep.).

The distribution of these communities is in response to exposure to wave action and light availability, largely determined by the depth and shape of the cave. They are therefore good indicators of the variety of sea cave habitats at Flamborough Head. The specialist algal and lichen communities are also considered to be sensitive to a number of external factors and therefore good indicators of changes in the marine environment.

Faunal cushion and crust communities - The faunal cushion and crust communities are an important structural component of the caves, particularly in the lower shore. The variety of these biotopes at Flamborough Head is a result of exposure to scouring, wave surge and degree of immersion.

Above the sand-scoured rock in the lower parts of the caves at Buckton Cliffs and Thornwick Bay, the breadcrumb sponge *Halichondria panicea* and *Clathrina coriacea*, the beadlet anemone *Actinia equina*, spirorbid polychaetes and the tubeworm *Pomatoceros triqueter* completely cover the vertical and overhanging walls. Where scour is not so great, crevices and pits in the caves are inhabited by the common mussel *Mytilus edulis*, with the barnacle *Semibalanus balanoides* and dogwhelk *Nucella lapillus.* Upper walls and ceilings of the caves are colonised by the barnacle *Semibalanus balanoides* and spirorbid polychaetes (Brazier *et al.* 1998).

Caves at the eastern end of the headland are particularly notable for being rich in certain sublittoral species. The bedrock floors of the caves are characterised by abundant *Sabellaria alveolata* and sponges such as *Leucosolenia* spp. or the chalk-boring yellow sponge *Clionia celata* and *Polydora* spp. worms, characteristic of the chalk habitats.

Fig3

4. Conservation objectives for all interest features

Under Regulation 33(2)(a) of The Conservation (Natural Habitats &c.) Regulations 1994, English Nature has a duty to advise other relevant authorities as to the conservation objectives for the European marine site. The conservation objectives for the Flamborough Head European marine site are provided below and should be read in the context of other advice given in this package, particularly:

- the attached maps showing the extent of the various interest features and sub-features;
- summary information on the interest of each of the features; and
- the favourable condition table, providing information on how to recognise favourable condition for each of the features and which will act as a basis from which the monitoring programme will be developed.

4.1 The conservation objective for the reefs

Subject to natural change, maintain the **reefs** in favourable condition[5], in particular:

- Rocky shore communities
- Kelp forest communities
- Subtidal faunal turf communities

4.2 The conservation objective for the submerged or partially submerged sea caves

Subject to natural change, maintain the **submerged or partially submerged sea caves** in favourable condition[5], in particular:

- Microalgal and lichen communities
- Faunal cushion and crust communities

[5] For a detailed definition of how to recognise favourable condition see Section 5 (Table 1)

5. Favourable condition table

The favourable condition table is supplied as an integral part of English Nature's Regulation 33 advice package. It is intended to supplement the conservation objectives only in relation to management of established and ongoing activities and future reporting requirements on monitoring the condition of the site and its features. The table **does not by itself** provide a comprehensive basis on which to assess plans and projects as required under Regulations 20 and 48-50, but it does provide a basis to inform the scope and nature of any 'appropriate assessment' that may be needed. It should be noted that appropriate assessments are, by contrast, a separate activity to condition monitoring, requiring consideration of issues specific to individual plans or projects. English Nature will provide more detailed advice to competent and relevant authorities to assess the implications of any given plan or project under the Regulations, where appropriate, at the time a plan or project is being considered.

The favourable condition table is the principle source of information that English Nature will use to assess the condition of an interest feature and as such comprises indicators of condition. On many terrestrial European sites, we know sufficient about the preferred or target condition of qualifying habitats to be able to define measures and associated targets for all attributes to be assessed in condition monitoring. Assessments as to whether individual interest features are in favourable condition will be made against these targets. In European marine sites we know far less about habitat condition and find it difficult to predict what favourable condition may look like. Individual sites within a single marine habitat category are also all very different, further hampering the identification of generic indicators of condition. Accordingly, in the absence of such information, condition of interest features in European marine sites will be assessed against targets based on the existing conditions, which may need to be established through baseline surveys in many cases.

The assumption that existing interest features on European marine sites are in favourable condition will be tested in the 2000 - 2006 reporting period and the results subsequently fed back into our advice and site management. Where there is more than one year's observations on the condition of marine habitats, all available information will need to be used to set the site within long-term trends in order to form a view on favourable condition. Where it may become clear that certain attributes are a cause for concern, and if detailed studies prove this correct, restorative management actions will need to be taken to return the interest feature from unfavourable to favourable condition. It is the intention of English Nature to provide quantification of targets in the favourable condition table during the 2000 - 2006 reporting period.

This advice also provides the basis for discussions with management and advisory groups, and as such the attributes and associated measures and targets may be modified over time. The aim is to produce a single agreed set of attributes that will then be monitored in order to report on the condition of features. Monitoring of the attributes may be of fairly coarse methodology, underpinned by more rigorous methods on specific areas within the site. To meet UK agreed common standards, English Nature will be committed to reporting on each of the attributes subsequently listed in the final version of the table, although the information to be used may be collected by other organisations through agreements.

The table will be an important, but not the only, driver of the site monitoring programme. Other data, such as results from compliance monitoring and appropriate assessments, will also have an important role in assessing condition. The monitoring programme will be developed as part of the management scheme process through discussion with the relevant authorities and other interested parties. English Nature will be responsible for collating the information required to assess condition and will form a judgement on the condition of each feature within the site, taking into account all available information and using the

favourable condition table as a guide.

Box 1	**Glossary of terms used in the favourable condition table**
Feature	The habitat or species for which the site has been selected.
Sub-feature	An ecologically important sub-division of the feature.
Attribute	Selected characteristic of an interest feature/sub-feature which provides an indication of the condition of the feature to which it applies.
Measure	What will be measured in terms of the units of measurement, arithmetic nature and frequency at which the measurement is taken. This measure will be attained using a range of methods, from broadscale to more specific, across the site.
Target	This defines the desired condition of an attribute, taking into account fluctuations due to natural change. Changes that are significantly different from the target will serve as a trigger mechanism through which some further investigation or remedial action is taken.
Comments	The rationale for selection of the attribute.

Table 1 Favourable Condition Table for the Flamborough Head European marine site

NB- Many of the attributes will be able to be monitored at the same time or during the same survey. The frequency of sampling for many attributes may need to be greater during the first reporting cycle in order to characterise the site and establish the baseline. For more detailed information on abbreviated biotopes in Measure and Comments columns, refer to Glossary and Appendix III.

Interest feature	Sub-feature	Attribute	Measure	Target	Comments
Reefs		Extent	Area (hectares) of the reefs, measured once per reporting cycle	No decrease in extent from an established baseline based on Davies & Sotheran (1995), subject to natural change	Extent is an attribute on which reporting is required by the Habitats Directive. The extent of reef will not change significantly over time unless due to some human activity but nevertheless needs to be measured periodically
		Water clarity	Average light attenuation measured during the summer season annually throughout the reporting cycle	Average light attenuation should not decrease significantly from a baseline to be established, subject to natural change	Water clarity is important for maintaining extent and density of algal dominated communities, such as kelp forest, and thus the structure of the feature. Clarity decreases through increases in amounts of suspended organic/inorganic matter. Siltation may also lead to smothering of biota and substrata affecting the structure of the interest feature by causing a reduction in feeding efficiency and colonisation
		Water density	Average water temperature, measured during winter/summer seasons annually throughout the reporting cycle	Average seasonal water temperatures for north and south sides of the headland should not deviate significantly from a baseline to be established, subject to natural change	The temperature difference between the north and south sides is characteristic of the overall hydrography of the area, in particular the Flamborough Front. Changes in temperature influences the presence and distribution of species (along with recruitment processes and spawning behaviour), providing supporting information when assessing condition of interest features

Interest feature	Sub-feature	Attribute	Measure	Target	Comments
Reefs	**Rocky shore communities**	Distribution and range of all intertidal biotopes	Distribution of intertidal rocky shore communities, using littoral extent, in particular those biotopes listed at Appendix III. Measured during summer, twice during reporting cycle	No decrease in littoral extent and range of biotopes from the established baseline (Brazier *et al.* 1998), subject to natural change	Flamborough Head intertidal is notable for its high number of biotopes. The relative distribution of rocky shore biotopes is an important structural aspect of the European marine site. Changes in extent and distribution may indicate long term changes in the physical conditions at the site
		Distribution of characteristic rocky shore communities	Distribution of intertidal chalk cliff algal and lichen biotopes Chr; Bli;UloUro. Measured in summer months twice during report cycle	Distribution should not deviate significantly from the established baseline (Tittley 1988), subject to natural change	Presence of Chr; Bli; UloUro are a structural component of the reef, but are particularly important due to their rarity. Also suggested that they may be useful indicators and therefore changes in extent and distribution may indicate long term changes in physical conditions at the European marine site
	Kelp forest communities	Distribution and range of kelp biotopes	Distribution of kelp dominated infralittoral communities measured using extent, in particular those biotopes listed at Appendix III. Measured during summer, twice during reporting cycle	No decrease in sublittoral extent and range of biotopes from the established baseline (Davies & Sotheran 1995; Brazier *et al.* 1998), subject to natural change	Extent and distribution of kelp biotopes is an important structural (composition) and functional (productivity) aspect of the European marine site. Changes in extent and distribution may indicate long term changes in the physical conditions at the site.
		Species composition of characteristic biotopes	Presence and abundance of composite species from biotope LhypFt. Measured during summer, twice during reporting cycle	Presence and abundance of composite species should not deviate significantly from a baseline to be established, subject to natural change	LhypFt is a major component of the kelp forest at Flamborough Head. Species composition is an important contributor to the structure of LhypFt and therefore the reef as a whole. The presence and relative abundance of characterising species gives an indication of the quality of LhypFt and change in composition may indicate cyclic change/ trend in reef communities

Interest feature	Sub-feature	Attribute	Measure	Target	Comments
Reefs	**Kelp forest communities**	Characteristic species-presence and abundance of *Ptilota gunneri* and *Odonthalia dentata*.	Presence and abundance of red feathery seaweed *Ptilota gunneri* and red alga *Odonthalia dentata*. Measured during summer, once during report cycle	Presence and abundance of these species should not deviate significantly from the established baseline (Brazier *et al.* 1996; 1998), subject to natural change	Characteristic species of red algae; *Ptilota gunneri* and *Odonthalia dentata* are regionally important. Species selected are "northern species" and not found further south on UK's east coast. They therefore act as indicators of changes in water circulation and temperature patterns, associated with the meeting of colder water body of the northern North Sea and warmer southern North Sea at the Flamborough Front
		Characteristic species-presence and abundance of *Calliblepharis ciliata, Halurus equisetifolius,* and *Taonia atomaria*.	Presence and abundance of algal species *Calliblepharis ciliata, Halurus equisetifolius,* and *Taonia atomaria*. Measured during summer, once during report cycle	Presence and abundance of these species should not deviate significantly from the established baseline (Brazier *et al.* 1996; 1998), subject to natural change	Characteristic species of algae; *Calliblepharis ciliata, Halurus equisetifolius,* and *Taonia atomaria* are regionally important. Species selected are "southern species" and not found further north on UK's east coast. They therefore act as indicators of changes in water circulation and temperature patterns, associated with the meeting of colder water body of the northern North Sea and warmer southern North Sea at the Flamborough Front

Interest feature	Sub-feature	Attribute	Measure	Target	Comments
	Subtidal faunal turf communities	Distribution and range of circalittoral biotopes	Distribution of circalittoral communities measured using extent, in particular those biotopes listed at Appendix III. Measured during summer, twice during reporting cycle	No decrease in the distribution and range of biotopes from the established baseline value (Davies & Sotheran 1995), subject to natural change	Flamborough Head subtidal is noted for the number and range of biotopes because they make up a significant proportion of the reef resource at this site. Relative distribution and number of circalittoral biotopes is an important structural and functional aspect of the European marine site. Changes in extent and variety may indicate long term changes in the physical conditions at the site
Reefs	**Subtidal faunal turf communities**	Species composition of characteristic biotopes	Presence and abundance of composite species from FluFlu; StoPaur; AlcByH.Hia. Measured during summer months, twice during reporting cycle	Presence and abundance of composite species should not deviate significantly from a baseline to be established, subject to natural change	FluFlu; StoPaur; AlcByH.Hia, are major components of the subtidal faunal turf reef communities at Flamborough Head. Species composition is an important contributor to the structure of FluFlu; StoPaur; AlcByH.Hia, and therefore the reef as a whole. The presence and relative abundance of characterising species of these biotopes is being used as an indicator of the health of the reef as a whole. Change in composition may indicate cyclic change/ trend in reef communities as a whole

Interest feature	Sub-feature	Attribute	Measure	Target	Comments
		Characteristic species- presence and abundance of *Archidistoma aggregatum* and *Polymastia boletiformis*	Presence and abundance of the ascidian *Archidistoma aggregatum* and the yellow sponge *Polymastia boletiformis.* Measured once during report cycle	Presence and abundance of these species should not deviate significantly from a baseline to be established, subject to natural change	Characteristic species *Archidistoma aggregatum* and the yellow sponge *Polymastia boletiformis* are of regional importance. Species selected are “southern” and not found further north on UK’s east coast. They therefore act as indicators of changes in water circulation and temperature patterns, associated with the meeting of colder water body of the northern North Sea and warmer southern North Sea at the Flamborough Front
		Characteristic species- presence and abundance of *Thuiaria thuja*	Presence and abundance of the bottle-brush hydroid *Thuiaria thuja* Measured once during report cycle	Presence and abundance of the species should not deviate significantly from a baseline to be established, subject to natural change	Characteristic species *Thuiaria thuja* is regionally important. Species selected is “northern” and not found further south on UK’s east coast. Therefore it acts as indicator of changes in water circulation and temperature patterns, associated with the meeting of colder water body of the northern North Sea and warmer souther North Sea at the Flamborough Front
Sea caves		Extent	Number and location, measured once during reporting cycle	No decrease in extent from a baseline to be established (Howson in prep.), subject to natural change	Extent is an attribute on which reporting is required by the Habitats Directive. The extent may alter as a result of natural erosion and collapses as well as a result of human activity, hence the need for periodic measurement

Interest feature	Sub-feature	Attribute	Measure	Target	Comments
	Specialist lichen and algal communities	Distribution of characteristic sea cave communities	Distribution of intertidal chalk cave algal and lichen biotopes RhoCv; Chr; Bli;UloUro. Measured during summer, once during reporting cycle	Distribution should not deviate significantly from a baseline to be established (Howson in prep.), subject to natural change	Distribution of RhoCv; Chr; Bli; UloUro are an important structural component of the chalk sea caves of Flamborough Head, and are particularly important due to their rarity. Changes in extent and distribution may indicate long term changes in physical conditions at the European marine site
	Faunal cushion and crust communities	Distribution of characteristic rocky shore communities	Distribution of intertidal chalk cave biotopes. Measured during summer, once during reporting cycle	Distribution should not deviate significantly from a baseline to be established (Howson in prep.), subject to natural change	Distribution of animal dominated biotopes within the sea caves at Flamborough Head is an important structural component. Changes in extent and distribution may indicate long term changes in physical conditions at the European marine site

NB .Extreme events (such as storms, reducing or increasing salinities, exceptionally cold winters or warm summers) also need to be recorded as they may be critical in influencing ecological issues at Flamborough Head and may well be missed by routine monitoring.

6. Advice on operations

English Nature has a duty under Regulation 33(2)(b) of the Conservation (Natural Habitats &c.) Regulations 1994 to advise other relevant authorities as to any operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species, for which the site has been designated. Information on how English Nature has developed this advice is given in section 6.2, and on how it may be reviewed and updated in the future, in section 6.4.

The advice is provided in summary form in Table 2 and section 6.5, and with more detail in Tables 3a & 3b and section 6.8, including advice in relation to specific interest features and sub-features.

6.1 Purpose of advice

The aim of this advice is to enable relevant authorities to direct and prioritise their work on the management of activities that pose the greatest potential threat to the favourable condition of interest features on the Flamborough Head European marine site. The advice is linked to the conservation objectives for interest features and, once issued, will help provide the basis for detailed discussions within the management group to formulate and agree a management scheme to agreed timescales for the site. The advice given here will inform on, but is without prejudice to, any advice to be given subsequently under Regulation 48 or Regulation 50 on operations that qualify as plans or projects within the meaning of Article 6 of the Habitats Directive.

6.2 Methods for assessment

To develop this advice on operations English Nature has used a three-step process involving:

- an assessment of **sensitivity** of the interest features or their component sub-features to operations;
- an assessment of the **exposure** of each interest feature or their component sub-features to operations; and
- a final assessment of **current vulnerability** of interest features or their component sub-features to operations.

This three-step process builds up a level of information necessary to manage activities in and around the European marine site in an effective manner. Through a consistent approach, this process enables English Nature to both explain the reasoning behind our advice and identify to competent and relevant authorities those operations which pose the most current threats to the favourable condition of the interest features on the European marine site.

All the scores of relative sensitivity, exposure and vulnerability are derived using best available scientific information and informed scientific interpretation and judgement. The process uses sufficiently coarse categorisation to minimise uncertainty in information, reflecting the current state of our knowledge and understanding of the marine environment. Information has been gathered from a range of sources including reports such as ABP Research & Consultancy (1999).

6.2.1 Sensitivity assessment

The sensitivity assessment used is an assessment of the relative sensitivity of the interest features or the component sub-features of the Flamborough Head European marine site to the effects of broad categories of human activities. In relation to this assessment, sensitivity has been defined as the intolerance of a habitat, community or individual (or individual colony) of a species to damage, or death, from an external factor (Hiscock 1996). As an example, kelp communities may be sensitive to increased turbidity resulting from suspended solids because it affects growth by reducing light penetration, which prevents adequate photosynthesis.

The sensitivity assessments of the interest features or their component sub-features of the Flamborough Head European marine site are based upon a series of scientific review documents. These include reports produced for the UK Marine SACs LIFE Project (Birkett *et al.* 1998; Hartnoll 1998; Hill *et al.* 1998; Gubbay & Knapman 1999; Saunders *et al*. 1998) and the Marine Habitats Reviews (Jones *et al.* in prep.).

The sensitivity assessments are based on current information but may develop with improvements in scientific knowledge and understanding. In particular, English Nature and Scottish Natural Heritage have commissioned the Marine Biological Association of the UK, through its Marine Life Information Network (MarLIN) to provide detailed sensitivity information to underpin this advice, over the next three years, and made available to all over the World Wide Web (www.marlin.ac.uk).

6.2.2 Exposure assessment

This has been undertaken for the Flamborough Head European marine site by assessing the relative exposure of the interest features or their component sub-features on the site to the effects of broad categories of human activities currently occurring on the site. For example, the exposure of interest features within the site to changes in the thermal regime as a result of human activities is negligible but exposure of some of the interest features to organic enrichment is moderate.

The assessment of exposure has been derived using information collated from relevant authorities and marine stakeholder groups during the Sensitive Marine Area (SMA) Project 1994- 1998 (Bayliss 1995a, 1995b; Howard 1998), see Table 3b. The SAC Management Group and Flamborough Head Maritime Forum, an advisory group in the SAC process, are represented by a significant number of the same organisations and interest groups previously involved in the SMA Project. Additional information relating specifically to the fishing industry has been produced in two reports (Senior 1999a; 1999b) as a result of a joint North Eastern Sea Fisheries Committee and English Nature project.

6.2.3 Vulnerability assessment

The third step in the process is to determine the vulnerability of the interest features or their component sub-features to operations. This is an integration of sensitivity and exposure. Only if a feature is both sensitive and exposed to a human activity will it be considered vulnerable. In this context therefore, ‘vulnerability’ has been defined as the exposure of a habitat, community or individual (or individual colony) of a species to an external factor to which it is sensitive (Hiscock 1996). For example, kelp forest is moderately sensitive to changes in salinity, but within the Flamborough Head European marine site, their exposure to this category of operation, at the current time, is low and hence its vulnerability is also currently low. The process of deriving and scoring relative vulnerability is provided in Appendix IV.

6.3 Format of advice

The advice is provided within six broad categories of operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species. This approach therefore:

- enables links to be made between human activities and the ecological requirements of the habitats or species, as required under Article 6 of the Habitats Directive;
- provides a consistent framework to enable relevant authorities in England to assess the effects of activities and identify priorities for management within their areas of responsibility; and
- is appropriately robust to take into account the development of novel activities or operations which may cause deterioration or disturbance to the interest features of the site and should have sufficient stability to need only infrequent review and updating by English Nature.

These broad categories provide a clear framework against which relevant authorities can assess activities under their responsibility. The more detailed information in Tables 3a & 3b provides relevant authorities with a context against which to consider an assessment of 'significant effect' of any plans or projects which may affect the site and a basis to inform on the scope and nature of appropriate assessments required in relation to plans and projects. It is important to note that this advice is only a starting point for assessing impacts. It does not remove the need for relevant authorities to formally consult English Nature over individual plans and projects where required to do so under the Conservation (Natural Habitats &c.) Regulations 1994.

6.4 Update and review of advice

Information as to the operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species, for which the site has been designated, is provided in light of what English Nature knows about current activities and patterns of usage (as at September 1999) at the Flamborough Head European marine site. English Nature expects that the information on current activities and patterns of usage (which was used to derive Table 2) will be supplemented during the process of developing the management scheme through further discussion with the relevant authorities. The option of zoning this information may be appropriate. As such, it is important that future consideration of this advice by relevant authorities and others takes account of changes in the usage patterns that have occurred at the site, over the intervening period, since the advice was issued. In contrast, the information provided in this advice on the sensitivity of interest features or sub-features (Table 3a) is relatively stable and will only change as a result of an improvement in our scientific knowledge, which will be a relatively long term process. Advice for sites will be kept under review and may be periodically updated through discussions with relevant authorities and others to reflect significant changes in our understanding of sensitivity together with the potential effects of plans and projects on the marine environment.

6.5 Summary of advice on operations

6.5.1 Reefs

In pursuit of the conservation objective for ‘reefs’ (section 4.1), the relevant and competent authorities for the Flamborough Head European marine site are advised to manage human activities within their remit such that they do not result in deterioration or disturbance to habitats or species for which the site has been selected, through any of the following:

- Physical loss by removal and/or smothering
- Physical damage by siltation and/or abrasion
- Toxic contamination by increased input of synthetic and/or non-synthetic compounds
- Non-toxic contamination by organic/nutrient enrichment and/or increased turbidity
- Biological disturbance as result of selective extraction of species.

6.5.2 Sea caves

In pursuit of the conservation objective for ‘submerged or partially submerged sea caves’ (section 4.2), the relevant and competent authorities for Flamborough Head European marine site are advised to manage human activities within their remit such that they do not result in deterioration or disturbance to habitats or species for which the site has been selected, through any of the following:

- Physical loss by removal
- Toxic contamination by increased input of synthetic and/or non-synthetic compounds
- Non-toxic contamination by organic/nutrient enrichment

Table 2 showing operations which may cause deterioration or disturbance to the Flamborough Head European marine site interest features at current levels of use[6,7,8].

The advice below is not a list of prohibitions but rather a checklist for operations which may need to be subject to some form of management measure(s) or further measures where actions are already in force. Examples of activities under relevant authority jurisdiction are provided. Operations marked with a **T** indicate those features (or some component of them) that are considered to be highly or moderately vulnerable to the effects of the operations.

Categories of operations which may cause deterioration or disturbance	Reefs	Sea caves
Physical loss		
Removal (e.g. harvesting, coastal development)	**U**	**U**
Smothering (e.g. disposal of dredge spoil)	**U**	
Physical damage		
Siltation (e.g. dredging, outfalls)	**U**	
Abrasion (e.g. mobile benthic fishing, anchoring, trampling)	**U**	
Selective extraction (e.g. aggregate dredging, entanglement)		
Non-physical disturbance		
Noise (e.g. boat activity)		
Visual (e.g. recreational activity)		
Toxic contamination		
Introduction of synthetic compounds (e.g. outfalls)	**U**	**U**
Introduction of non-synthetic compounds (e.g. outfalls, spills)	**U**	**U**
Introduction of radionuclides		
Non-toxic contamination		
Nutrient enrichment (e.g. agricultural run-off, outfalls)	**U**	**U**
Organic enrichment (e.g. mariculture, outfalls)	**U**	**U**
Changes in thermal regime (e.g. outfalls, power stations)		
Changes in turbidity (e.g. dredging)	**U**	
Changes in salinity (e.g. water abstraction, outfalls)		
Biological disturbance		
Introduction of microbial pathogens		
Introduction of non-native species & translocation		
Selective extraction of species (e.g. bait collection, fishing)	**U**	

[6] This advice has been developed using best available scientific information and informed scientific interpretation and judgement (as at September 1999). This process has used a coarse grading of relative sensitivity, exposure and vulnerability of each interest feature to different categories of operation based on the current state of our knowledge and understanding of the marine environment (Tables 3a & 3b; Appendix IV). The advice is indicative only, and is given to guide relevant authorities and others on particular operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species for which the site has been designated. The advice, therefore, is not a list of prohibitions but rather a checklist for operations which may need to be subject to some form of management measure(s) or further measures where actions are already in force.

[7] The precise impact of any category of operation occurring on the site will be dependent upon the nature, scale, location and timing of events. More detailed advice is available from English Nature to assist relevant authorities in assessing actual impacts and cumulative effects. Assessment of this information should be undertaken in the development of the management scheme by the management group and through wider consultation.

[8] In accordance with Government policy guidance, the advice on operations is feature and site specific, and provided in the light of current activities and patterns of usage at the site (as at September 1999) that have occurred over the intervening period. Advice for sites will be kept under review and may be periodically updated through discussions with relevant authorities, and others, to reflect significant changes in our understanding of sensitivity together with the potential effects of plans and projects on the marine environment. The provision of the statutory advice given here, on operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species, for which the site has been designated, under Regulation 33(2), is provided without prejudice to, any advice to be given subsequently under Regulation 48(3) or Regulation 50 on individual operations that qualify as plans or projects within the meaning of Article 6 of the Habitats Directive.

6.6 Plans and Projects

Under Regulation 48(1), an appropriate assessment needs to be undertaken in respect of any plan or project which:

a. either alone or in combination with other plans or projects would be likely to have a ***significant effect*** on a European Site; and
b. is not directly connected with the management of the site for nature conservation.

An appropriate assessment is required by law for all European Sites (Regulation 48). A European Site is any classified SPA and any SAC from the point where the Union and the Government agree the site as a Site of Community Importance. Appropriate assessment is also required, as a matter of Government policy, for potential SPAs, candidate SACs and listed Ramsar Sites for the purpose of considering development proposals affecting them. (PPG 9 paras 13 and C7).

English Nature's 'Habitats regulations guidance note: The Appropriate Assessment (Regulation 48)', is at Appendix V for further information.

Tables 2, 3a & 3b in this Regulation 33 package provide relevant authorities with a guide against which to initiate an assessment of 'significance' of any plans or projects (and ongoing operations or activities) proposed for the site, although this will only be the starting point for assessing impacts and does not remove the need for relevant authorities to formally consult English Nature over individual plans and projects where required under the Regulations.

6.7 Review of consents

Regulation 50 of The Conservation (Natural Habitats &c.) Regulations 1994 requires competent authorities to undertake a review of all existing consents and permissions affecting cSAC and SPAs, as soon as possible after the site officially becomes a Site of Community Importance. This will have implications for discharge and other consents, which will need to be reviewed in light of these objectives and may mean that lower targets for background levels of contaminants etc will need to be set.

6.8 Interest feature and sub-feature specific advice

This section provides information to help relate general advice to each of the specific interest features of the Flamborough Head European marine site.

This advice relates to the vulnerability of the interest features and sub-features of the Flamborough Head European marine site as summarised in Table 2 and detailed in Tables 3a & 3b. An explanation of the sensitivity of the interest features or sub-features follows, with examples of their exposure and therefore their vulnerability to damage or disturbance from the listed categories of operations. This enables links to be made between the categories of operations and the ecological requirements of the European marine site's interest features, as set out in Section 3.

6.8.1 Reefs

Physical loss

- The extensive areas of chalk reefs at Flamborough Head are of international marine conservation importance as they support a wide variety and unique range of marine habitats and species. The loss of the reef, or any part of it, could jeopardise the survival of some of these habitats or species and would therefore be detrimental to the favourable condition of the reef.
- All the sub-features of the reef are considered sensitive to physical loss through direct removal or smothering, because such losses would be permanent. Furthermore, many of these communities are dependent upon the ecological functioning of others and the loss of one may have major implications on the condition of others. This linkage should not, therefore, be overlooked when the potential impact of removal or smothering is considered.
- Subtidal habitats on the south side of the headland are considered particularly vulnerable to physical loss since they are more exposed to the potential effects of smothering due to proximity to outfall pipes and dredged spoil disposal areas.
- Deterioration or disturbance to reef sub-features by physical removal or smothering can be the result of either one-off events or the cumulative effect of activities.

Physical damage

- Chalk reef communities at Flamborough Head are sensitive to physical damage resulting from siltation, abrasion or selective extraction. Siltation can smother or block the feeding/ respiratory organs of animals or can effect recruitment processes. Abrasion can result in the dislodgement of species or damage the structure of habitats. Damage to the reef, or any part of it, thorough selective extraction could jeopardise the survival of some of these habitats or species and would therefore be detrimental to the favourable condition of the reef. This is because many of these communities are dependent upon the ecological functioning of others and the loss of one may have major implications on the condition of others
- Most intertidal communities at Flamborough Head are less sensitive to physical damage than subtidal communities because of their adaptation to the physical processes to which they are normally subjected, which generally results in rapid recolonisation and growth. The rocky shores are, however, considered to be moderately vulnerable to abrasion since the effects of trampling may result in abrasion of newly settled spores and recruits at certain times of the year. If such damage is intensive and persistent, particularly on accessible shores around the eastern end of the headland, it may result in damage to fucoid communities, thus altering the natural cycle of the rocky shore ecology. The exposure of rocky shore communities to activities or operations resulting in physical damage from siltation or selective extraction is, however, currently considered negligible.

Table 3a. Sensitivity and vulnerability matrix for the Flamborough Head European marine site interest features[9]

Categories of operations which may cause deterioration or disturbance	Interest features/sub-features				
	Reefs			Sea caves	
	Rocky shore	Kelp forest	Subtidal faunal turf	Microalgal and lichen	Faunal cushion and crust
Physical Loss					
Removal (e.g. harvesting, land claim)	ž ž ž ž	ž ž ž ž	ž ž ž ž	ž ž ž ž	ž ž ž ž
Smothering (e.g. disposal of dredge spoil)	ž ž ž	ž ž ž	ž ž ž	ž ž	ž ž
Physical Damage					
Siltation (e.g. dredging, outfalls)	ž ž ž	ž ž ž ž	ž ž ž ž	ž ž	ž ž
Abrasion (e.g. mobile benthic fishing, anchoring, trampling)	ž ž ž	ž ž ž	ž ž ž	ž ž	ž ž ž
Selective extraction (e.g. aggregate dredging, entanglement)	ž ž ž	ž ž ž	ž ž ž	ž ž	ž ž
Non-physical disturbance					
Noise (e.g. boat activity)	ž	ž	ž	ž	ž
Visual presence (e.g. recreational activity)	ž	ž	ž	ž	ž
Toxic contamination					
Introduction of synthetic compounds (e.g. outfalls)	ž ž ž ž	ž ž ž ž	ž ž ž ž	ž ž ž ž	ž ž ž ž
Introduction of non-synthetic compounds (e.g. outfalls, spills)	ž ž ž	ž ž ž	ž ž ž	ž ž ž	ž ž ž
Introduction of radionuclides	ž ž	ž ž	ž ž	ž ž	ž ž
Non-toxic contamination					
Nutrient enrichment (e.g. agricultural run-off, outfalls)	ž ž ž	ž ž ž	ž ž ž	ž ž ž	ž ž
Organic enrichment (e.g. mariculture, outfalls)	ž ž ž	ž ž ž	ž ž ž	ž ž ž	ž ž
Changes in thermal regime (e.g. outfalls, power stations)	ž ž	ž ž ž	**ž ž ž**	ž ž	ž ž ž
Changes in turbidity (e.g. dredging)	ž ž	ž ž ž	ž ž	ž ž	ž ž
Changes in salinity (e.g. water abstraction, outfalls)	ž ž	ž ž ž	ž ž ž	ž ž	ž ž ž
Biological disturbance					
Introduction of microbial pathogens	ž ž	ž ž	ž ž	ž ž	ž ž
Introduction of non-native species & translocation	ž ž ž	ž ž ž	ž ž ž	ž ž ž	ž ž ž
Selective extraction of species (e.g. bait collection, fishing)	ž ž ž	ž ž ž	ž ž ž	ž ž ž	ž ž ž

	High vulnerability	ž ž ž ž	High sensitivity
	Moderate vulnerability	ž ž ž	Moderate sensitivity
		ž ž	Low sensitivity

[9] English Nature's advice on operations is derived from an assessment combining relative sensitivity of the features or sub-features with information on human usage of the site (as at September 1999), to identify relative vulnerability to categories of operations (Appendix IV).

ž No detectable sensitivity

Table 3b. Exposure assessment of interest features of the Flamborough Head European marine site based on current levels of usage at the site[10]

Categories of operations which may cause deterioration or disturbance	Interest features/sub-features				
	Reefs			Sea caves	
	Rocky shore	Kelp forest	Subtidal faunal turf	Microalgal and lichen	Faunal cushion and crust
Physical Loss					
Removal (e.g. harvesting, land claim)	**Low**	**Low**	**Low**	**Low**	**Low**
Smothering (e.g. disposal of dredge spoil)	**Low**	**Med**	**Med**	**Low**	**Low**
Physical Damage					
Siltation (e.g. dredging, outfalls)	**Low**	**Med**	**Med**	**Low**	**Low**
Abrasion (e.g. mobile benthic fishing, anchoring, trampling)	**Med**	**Low**	**Med**	**Low**	**Low**
Selective extraction (e.g. aggregate dredging, entanglement)	**None**	**None**	**Low**	**None**	**None**
Non-physical disturbance					
Noise (e.g. boat activity)	**Med**	**Med**	**Med**	**Low**	**Low**
Visual presence (e.g. recreational activity)	**Med**	**Med**	**Med**	**Low**	**Low**
Toxic contamination					
Introduction of synthetic compounds (e.g. outfalls)	**Med**	**Med**	**Med**	**Med**	**Med**
Introduction of non-synthetic compounds (e.g. outfalls, spills)	**Med**	**Med**	**Med**	**Med**	**Med**
Introduction of radionuclides	**None**	**None**	**None**	**None**	**None**
Non-toxic contamination					
Nutrient enrichment (e.g. agricultural run-off, outfalls)	**Med**	**Med**	**Med**	**Med**	**Med**
Organic enrichment (e.g. mariculture, outfalls)	**Med**	**Med**	**Med**	**Med**	**Med**
Changes in thermal regime (e.g. outfalls, power stations)	**None**	**None**	**None**	**None**	**None**
Changes in turbidity (e.g. dredging)	**Low**	**Med**	**Med**	**None**	**None**
Changes in salinity (e.g. water abstraction, outfalls)	**Low**	**Low**	**Low**	**None**	**None**
Biological disturbance					
Introduction of microbial pathogens	**Low**	**Low**	**Low**	**Low**	**Low**
Introduction of non-native species & translocation	**Low**	**Low**	**Low**	**Low**	**Low**
Selective extraction of species (e.g. bait collection, fishing)	**Low**	**Med**	**Med**	**None**	**None**

[10] In accordance with Government policy guidance, this advice is provided in light of current activities and patterns of usage at the site (as at September 1999). It is important therefore that future consideration of this advice by relevant authorities, and others, takes account of changes in the usage patterns at the site. In contrast, the sensitivity of interest features, or sub-features, is relatively stable with alterations reflecting improvement in our scientific knowledge and understanding. To this end, information on sensitivity has been included in Table 3a to assist the management group and advisory groups with future management of the site.

Key:	**High**	High exposure	**Med**	Medium exposure
	Low	Low exposure	**None**	No detectable exposure

- Kelp forest communities are considered to be vulnerable to physical damage by siltation due to their exposure to outfalls and a dredged spoil disposal area. Deposition of silt can cover available hard substrata which interferes with the process of spore attachment (Jones *et al.* 1998). It can also smother young plants, inhibiting their growth and development, or holdfasts which contain a diverse range of filter feeders. The exposure of kelp forest communities to activities or operations resulting in physical damage from abrasion or selective extraction is, however, currently negligible.
- Subtidal faunal turf communities at Flamborough Head are currently considered to be exposed to the effects of outfalls and a dredged spoil disposal area. Deposition of silt can cover available hard substrata which interferes with the process of attachment. It can also smother species, inhibiting their growth and development, particularly filter feeders. Subtidal faunal turf communities at Flamborough Head are currently considered to be exposed to the effects of mobile benthic fishing. These operations should, however, be assessed in the context of the intensity and type of gear used, as set out in the two reports; '*Preliminary study investigating the types and potential effects of fishing activities in and around the Flamborough Head candidate Special Area of Conservation site*' (Senior 1999a) and '*The Flamborough Head cSAC fishing fleet (1999): Inventory of vessels and gear and analysis of fishing effort*' (Senior 1999b), reference should also be made to Gubbay & Knapman (1999).

Toxic contamination

- Synthetic compounds include pesticides, Polychlorinatedbiphenyls (PCBs) and Tributyltin (TBT). Non-synthetic compounds include heavy metals, such as cadmium, lead and mercury, or oil. All are known to have toxic effects in low concentrations, with larval stages being particularly sensitive, and to be capable of bioaccumulation (Hartnoll 1998) within a foodchain. Reef communities are recognised as being sensitive to toxic contamination because faunal communities primarily consist of filter feeders and marine species which rely on larval dispersion for recruitment. Changes to the reef communities, or any part of them, could jeopardise the survival of some of these communities or species and would therefore be detrimental to the favourable condition of the reef.
- At Flamborough Head faunal communities in both the intertidal and subtidal are considered to be vulnerable to toxic contaminants given their proximity to outfall pipes and dredged spoil disposal areas, which are potential sources of contaminant input. Toxic contaminants in the marine environment are, however, often the result of diffuse sources and therefore difficult to identify.
- Faunal turfs are characterised by molluscs, sponges, hydroids, soft corals, annelid worms and bryozoans. Disturbance to species composition of reef communities may result in changes to population structure, through loss of key grazers or predators, e.g. limpets or dogwhelks, or bioaccumulation, e.g. plaice feeding on mussels, thus affecting favourable condition and is considered harmful. Dogwhelks at South Landing have been shown to exhibit imposex (Morris 1991), which is a condition induced by TBT at concentrations of around 2-3ng Sn 1-1 and above (Hill *et al.* 1998).
- Intertidal reef communities of Flamborough Head are sensitive to acute events, such as oil spills, due to their toxicity and smothering effects, although exposure is minimal. They often take many years to recover, 5 to 15, depending upon recruitment rates and dispersal of toxic substance.

Non-toxic contamination

- The composition and diversity of reef communities at Flamborough Head is partly a result of it being situated in an important biogeographic position, at the meeting point of two different oceanic systems. Activities or operations which significantly alter the physical and chemical regime of the waters off Flamborough Head may change the community structure of the reefs. Changes to the reef communities, or any part of them, could jeopardise the survival of some of these habitats or species and would therefore be detrimental to the favourable condition of the reef.
- Reef communities are sensitive to nutrient/organic enrichment, because they have the potential to be altered due to some species being more competitive than others. This could lead to a dominance by a single or few species which could change the structural composition and potentially lead to a reduction in species diversity and biotopes, characteristic of the reef communities at Flamborough Head. These communities are currently considered to be exposed to the effects of agricultural run-off, industrial and waste water outfall pipes.
- Increased water turbidity influences the ability of kelp and other algal species to photosynthesise, and this affects the maximum depth at which the kelp can grow. Therefore activities resulting in a reduction in water clarity may affect the growth and survival of kelp forest at Flamborough Head, an important primary producer and habitat. Kelp communities at Flamborough Head are currently considered to be exposed to the effects of activities such as the dumping of dredged spoil south of the headland and proximity to industrial outfall pipes.
- Subtidal reef communities at Flamborough Head are considered to be more sensitive to changes in salinity and temperature than intertidal communities, which are exposed to daily temperature and salinity changes, because there is the potential to significantly alter the distribution and structure of the reef biotopes. The exposure of reef sub-features to activities or operations resulting in changes to these physical parameters is, however, currently minimal.

Biological disturbance

- Over exploitation of shellfish, demersal or pelagic fisheries, either commercially or through recreational pursuits, within the European marine site may disrupt the stability of reef communities, the functional regime of the reefs at Flamborough Head or the fisheries themselves. This is because the removal of particular species or predators from a marine food web, or trophic level, not only affects that population, but can also have a knock on effect for associated species, for example kittiwake. Due to the complexity of marine systems and mobility of species being influenced by seasonal and climatic conditions, the precise impacts of selective extraction of these different types of fisheries is presently unclear.
- Commercial and recreational fisheries have long been a common activity within and around the European marine site (Senior 1999a; 1999b), resulting in the selective extraction of species from nearshore waters, chalk habitats and associated kelp forest habitats. These areas are considered to be important habitats for a diverse assemblage of species and the precise impacts of selective extraction on these habitats is presently unclear, therefore a precautionary approach should be used when managing increased fishing effort or use of ‘new’ gear in the area.
- Collection of marine plants and animals from the intertidal area, whether for food or bait, results in the selective extraction of species. Rocky shore communities are sensitive to selective extraction due to the potential effects it could have on the structural composition by the removal of key species. Rocky shore communities at Flamborough Head are not considered vulnerable to the effects of selective extraction, at current levels.

- Reef communities are sensitive to the introduction of competitive non-native species because of the potential impact on community structure. The reef communities at Flamborough Head are currently not vulnerable to the effects of introduced non-native species due to their low exposure.

6.6.2 Sea caves

Physical loss

- The extent and number of chalk sea caves at Flamborough Head are of international marine nature conservation importance because they support a wide variety and unique range of habitats and specialist marine plant and animal communities which attach to or burrow into the bedrock. Loss of the sea caves, or any parts of it, could jeopardise the survival of some of these habitats or species and would be detrimental to the favourable condition of the sea caves.
- Both the sub-features are considered sensitive to physical loss through direct removal because such losses would be permanent. The microalgal/ lichen communities at Flamborough Head are nationally rare biotopes, whilst many of the faunal cushion and crust communities are dependent upon the ecological functioning of others so the loss of one may have implications on the condition of others. This linkage should not, therefore, be overlooked when the potential impact of removal is considered.
- Deterioration or disturbance by physical removal can be the result of either one-off events or the cumulative effects of activities.

Physical damage

- Faunal cushion and crust communities are sensitive to physical damage resulting from abrasion which can result in the dislodgement or damage to the structure of habitats and species. However given their inaccessibility and location, the sea cave sub-features at Flamborough Head are not considered to be vulnerable to this category of operation, based on their low exposure to current levels of usage at the site.

Toxic contamination

- Sea cave communities, including microalgal, lichen and faunal turf, are vulnerable to toxic contamination for the same reasons as reef communities. Therefore changes to the sea cave communities, or any part of them, could jeopardise the survival of some of these communities or species and would therefore be detrimental to the favourable condition of the sea caves.
- Intertidal sea cave communities at Flamborough Head are sensitive to acute events, such as oil spills, due to their toxicity and smothering effects. Recovery time will depend upon recruitment rates and dispersal of toxic substance. Although the complex and intricate topography of the caves will itself contribute to the persistence of harmful substances.

Non-toxic contamination

- Microalgal and lichen communities are sensitive to nutrient/organic enrichment, because they have the potential to be altered due to some species being intolerant to such conditions or some more competitive than others. This could lead to a dominance by a single or few species which could change the structural composition and potentially lead to a reduction in species diversity and biotopes, characteristic of these specialised communities at Flamborough Head. These communities are currently considered to be exposed to the effects of agricultural run-off, industrial and waste water outfall pipes.
- The faunal cushion and crust sea cave communities at Flamborough Head are more sensitive to fluctuations in salinity and temperature because there is the potential to significantly alter the distribution and structure of the sub-feature communities in this specialised habitat. The exposure of sea cave sub-features to activities or operations resulting in changes to these physical parameters is, however, currently negligible.

Biological disturbance

- The sea cave communities are sensitive to the introduction of competitive non-native species and the extraction of selected species because of the potential impact on community structure. The sea cave communities at Flamborough Head are currently considered to have a low or negligible exposure to activities that may result in biological disturbance.

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8. Glossary

Advisory Group — The body of representatives from local interests, user groups and conservation groups, formed to advise the management group.

Annex I habitat(s) — A natural habitat(s) listed in Annex I of the Habitats Directive for which Special Areas of Conservation can be selected.

Annex II species — A species listed in Annex II of the Habitats Directive for which Special Areas of Conservation can be selected.

Attribute — Characteristic of an interest feature/ sub-feature which provides an indication of the condition of the feature or sub-feature to which it applies.

Benthos — Those organisms attached to, or living on, in or near, the seabed, including that part which is exposed by tides.

Biotope — The physical habitat with its biological community; a term which refers to the combination of physical environment and its distinctive assemblage of conspicuous species.

Biodiversity — The total variety of life on earth. This includes diversity within species, between species and of ecosystems.

Characteristic — Special to or especially abundant in a particular situation or biotope. Characteristic species should be immediately conspicuous and easily identified.

Circalittoral — The rocky subtidal zone below that dominated by algae (Animal dominated subtidal zone)

Community — A group of organisms occurring in a particular environment, presumably interacting with each other and with the environment, and identifiable by means of ecological survey from other groups.

Competent authority — Any Minister, government department, public or statutory undertaker, public body or person holding a public office that exercises legislative powers.

Conservation objective — Statement of the nature conservation aspirations for a site, expressed in terms of the favourable condition that we wish to see the species and/or habitats for which the site has been selected to attain. Conservation objectives for European marine sites relate to the aims of the Habitats Directive.

European marine site — A European site (SAC or SPA) which consists of, or in so far as it consists of, marine areas.

Favourable conservation status	A range of conditions for a natural habitat or species at which the sum of the influences acting upon that habitat or species are not adversely affecting its distribution, abundance, structure or function throughout the EU in the long term. The condition in which the habitat or species is capable of sustaining itself on a long-term basis.
Favourable condition	A range of conditions for a natural habitat or species at which the sum of the influences acting upon that habitat or species are not adversely affecting its distribution, abundance, structure or function within an individual Natura 2000 site in the long term. The condition in which the habitat or species is capable of sustaining itself on a long-term basis.
Habitat	The place in which a plant or animal lives.
Habitats Directive	The abbreviated term for *Council Directive 92/43/EEC of 21 May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora*. It is the aim of this Directive to promote the conservation of certain habitats and species within the European Union.
Infralittoral	The subtidal zone in which upward facing rocks are dominated by erect algae, typically kelps.
Interest feature	A natural or semi-natural feature for which a European site has been selected. This includes any Habitats Directive Annex I habitat, or specific component of their fauna and flora, or any Annex II species and any population of a bird species for which a SPA has been designated under the Birds Directive. Any habitat of a species for which the site has been selected, or typical species of an Annex I habitat are also considered to be interest features.
Maintain	The action required for an interest feature when it is considered to be in favourable condition.
Management Group	The body of relevant authorities formed to manage the European marine site.
Management scheme	The framework established by the relevant authorities at a European marine site under which their functions are exercised to secure, in relation to that site, compliance with the requirements of the Habitats Directive.
Nationally scarce/rare	For marine purposes, these are regarded as species of limited national occurrence.
Natura 2000	The European network of protected sites established under the Birds Directive and the Habitats Directive.

Operations which may cause deterioration or disturbance	Any activity or operation taking place within, adjacent to, or remote from a European marine site that has the potential to cause deterioration to the natural habitats for which the site was designated or disturbance to the species and its habitats for which the site was designated.
Plan or project	Any proposed development that is within a relevant authority's function to control, or over which a competent authority has a statutory function to decide on applications for consents, authorisations, licences or permissions.
Relevant authority	The specific competent authority which has powers or functions which have, or could have, an impact on the marine environment within, or adjacent to, a European marine site.
Restore	The action required for an interest feature when it is not considered to be in a favourable condition.
Sensitivity	The intolerance of a habitat, community or individual species to damage or disturbance from an external force.
Sub-feature	An ecologically important sub-division of an interest feature.
Vulnerability	The likelihood of a habitat, community or individual of a species being exposed to an external factor to which it is sensitive.

Appendix I List of relevant authorities for the Flamborough Head European marine site

Harbour Master
Bridlington Harbour Commissioners
Gummers Wharf
West End
Bridlington
East Yorkshire YO15 3AN

Sustainable Development Manager
Economic Development, Tourism and Forward Planning
East Riding of Yorkshire Council
County Hall
Beverley
East Yorkshire HU17 9BA

Conservation Officer- East Riding
English Nature
North and East Yorkshire Team
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Science Park
Heslington
York YO10 5ZQ

FER Manager
Environment Agency
Ridings Area
Phoenix House
Global Avenue
Leeds LS11 8PG

Flamborough and North Landing Harbour Commissioners
West Kapelle
Woodcock Road
Flamborough
East Yorkshire YO15 1LL

Chief Fisheries Officer
North Eastern Sea Fisheries Committee
Town Hall
Bridlington
East Yorkshire YO16 4LP

Head of Heritage Service
Environment Department
North Yorkshire County Council
County Hall
Northallerton
North Yorkshire DL7 8AH

Director of Technical Services
Scarborough Borough Council
Town Hall
St. Nicholas Street
Scarborough
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Legal and Insurance Manager
Trinity House Lighthouse Service
Trinity House
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Head of Safety, Health and Environment
Yorkshire Water Services ltd
Western House
Western Way
Halifax Road
Bradford BD6 2LZ

Appendix IIa Map of Flamborough Head candidate SAC

Appendix IIb Map of the Flamborough Head and Bempton Cliffs SPA

Appendix III Summary of key biotopes recorded in the Flamborough Head European marine site

A number of habitats, community types and species present at Flamborough Head are of special interest, either for their rarity, conservation importance or their characteristic regional distribution. The key biotopes are summarised below; listed as MNCR biotopes (Connor *et al.* 1997). For additional information on biotopes refer to Connor *et al.* (1997) and their distribution at Flamborough Head, refer to Brazier *et al.* (1998).

Key biotopes

MNCR Biotope	**Brief description (Connor *et al*. 1997)**	**Frequency of occurrence in Britain**
LITTORAL ROCK (LR.L)	**Lichens or algal crusts**	
Ver.Ver	*Verrucaria maura* on very exposed to very sheltered upper littoral fringe rock	Very common
Chr	Chrysophyceae on vertical upper littoral fringe soft rock	Rare
Bli	*Blidingia* spp., on vertical littoral fringe soft rock	Rare
UloUro	*Ulothrix flacca* and *Urospora* spp., on freshwater-influenced vertical littoral fringe soft rock	Rare
EXPOSED LITTORAL ROCK (ELR.MB)	***Mytilus* (mussels) and barnacle shores**	
MytB	*Mytilus edulis* and barnacles on very exposed eulittoral rock	Common
BPat	Barnacles and *Patella* spp on exposed or moderately exposed, or vertical sheltered, eulittoral rock	Very common
BPat.Sem	*Semibalanus balanoides* on exposed or moderately exposed, or vertical sheltered eulittoral rock	Very common
(ELR.FR)	**Robust fucoids or red seaweeds**	
Him	*Himanthalia elongata* and red seaweeds on exposed lower eulittoral rock	Common
MODERATELY EXPOSED LITTORAL ROCK (MLR.BF)	**Barnacles and fucoids (moderately exposed shores)**	
FvesB	*Fucus vesiculosus* and barnacle mosaics on moderately exposed and mid eulittoral rock	Very common
Fser	*Fucus serratus* on moderately exposed lower eulittoral rock	Very common
Fser.Fser	Dense *Fucus serratus* on moderately exposed to very sheltered lower eulittoral rock	Very common
Fser.Fser.Bo	*Fucus serratus* and under-boulder fauna on lower eulittoral boulders	Common

(MLR.R)	**Red seaweeds (moderately exposed shores)**	
Mas	*Mastocarpus stellatus* and *Chondrus crispus* on very to moderately exposed lower eulittoral rock	Scarce
(MLR.Eph)	**Ephemeral green or red seaweeds (freshwater or sand-influenced)**	
Ent	*Enteromorpha* spp on freshwater-influenced or unstable upper eulittoral rock	Uncommon
EntPor	*Porphyra purpurea* or *Enteromorpha* spp on sand-scoured mid or lower eulittoral rock	Scarce
Rho	*Rhodothamniella floridula* on sand-scoured lower eulittoral rock	Uncommon
(MLR.MF)	***Mytilus* (mussels) and fucoids (moderately exposed shores)**	
MytFves	*Mytilus edulis* and *Fucus vesiculosus* on moderately exposed mid eulittoral rock	Scarce
MytFR	*Mytilus edulis*, *Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock	Rare
SHELTERED LITTORAL ROCK (SLR.F)	**Dense fucoids (Stable rock)**	
Fspi	*Fucus spiralis* on moderately exposed to very sheltered upper eulittoral rock	Very common
Fves	*Fucus vesiculosus* on sheltered mid eulittoral rock	Very common
LITTORAL ROCK (OTHER) (LR.Rkp)	**Rockpools**	
Cor	*Corallina officinalis* and coralline crusts in shallow eulittoral rockpools	Very common
FK	Fucoids and kelps in deep eulittoral rockpools	Common
SwSed	Seaweeds in sediment (sand or gravel)-floored eulittoral rockpools	Common
(LR.Ov)	**Overhangs and caves**	
RhoCv	*Rhodothamniella floridula* in upper littoral fringe soft rock caves	Rare
SR	Sponges and shade-tolerant red seaweeds on overhanging lower eulittoral bedrock	Common
EXPOSED INFRALITTORAL ROCK (EIR)		
(EIR.KFaR)	**Kelp with cushion fauna, foliose red seaweeds or coralline crusts (exposed rock)**	
LhypFa	*Laminaria hyperborea* forest with a faunal cushion (sponges and polyclinids) and foliose red seaweeds on very exposed upper infralittoral rock	Uncommon
FoR	Foliose red seaweeds on exposed or moderately exposed lower infralittoral rock	
(EIR.SG)	**Robust faunal cushions and crusts (surge gullies and caves)**	

SCAn.Tub	Sponge crusts, anemones and *Tubularia indivisa* in shallow infralittoral surge gullies	
SCAs.ByH	Sponge crusts, colonial (polyclinid) ascidians and a bryozoan/hydroid turf on wave-surged vertical or overhanging infralittoral rock	
CC.BalPom	*Balanus crenatus* and/or *Pomatoceros triqueter* with spirorbid worms and coralline crusts on severely scoured vertical infralittoral rock	Uncommon
MODERATELY EXPOSED INFRALITTORAL ROCK (MIR)		
(MIR.KR)	**Kelp with red seaweeds (moderately exposed rock)**	
Ldig	*Laminaria digitata* on moderately exposed or tide-swept sublittoral fringe rock	Very common
Ldig.Ldig	*Laminaria digitata* on moderately exposed sublittoral fringe rock	Very common
Lhyp.Ft	*Laminaria hyperborea* forest and foliose red seaweeds on moderately exposed upper infralittoral rock	Very common
Lhyp.Pk	*Laminaria hyperborea* park foliose red seaweeds on moderately exposed lower infralittoral rock	Common
Lhyp.Tft	*Laminaria hyperborea* forest, foliose red seaweeds and a diverse fauna on tide-swept upper infralittoral rock	Uncommon
(MIR.SedK)	**Sand or gravel-affected or disturbed kelp and seaweed communities**	
XKScrR	Mixed kelps with scour-tolerant and opportunistic foliose red seaweeds on scoured or sand-covered infralittoral rock	
EphR	Ephemeral red seaweeds and kelps on tide-swept mobile infralittoral cobbles	Uncommon
INFRALITTORAL ROCK (OTHER) (IR)		
(IR.FaSwV)	**Fauna and seaweeds (shallow vertical rock)**	
AlcByH	*Alcyonium digitatum* with a bryozoan, hydroid and ascidian turf on moderately exposed vertical infralittoral rock	Common
AlcByH.Hia	*Alcyonium digitatum, Hiatella arctica*, bryozoan, hydroid and ascidian turf on moderately exposed vertical infralittoral rock	
MODERATELY EXPOSED CIRCALITTORAL ROCK (MCR)		
(MCR.ByH)	**Bryozoan/hydroid turfs (sand-influenced)**	
Flu.Flu	*Flustra foliacea* on slightly scoured silty circalittoral rock or mixed substrata	Very common
Flu.SerHyd	*Sertularia argentea, S. cupressina* and *Hydrallmania falcata* on tide-swept circalittoral cobbles and pebbles	

Urt.Urt	*Urticina felina* on sand-scoured circalittoral rock	
(MCR.M)	**Mussel beds (open coast circalittoral rock/mixed substrata)**	
MytHAs	*Mytilus edulis* beds with hydroids and ascidians on tide-swept moderately exposed circalittoral rock	
(MCR.Bri)	**Brittlestar beds**	
Oph	*Ophiothrix fragilis* and/or *Ophiocomina nigra* beds on slightly tide-swept circalittoral rock or mixed substrata	Very common
(MCR.GzFa)	**Grazed fauna (moderately exposed or sheltered rock)**	
FaAlC	Faunal and algal crusts, *Echinus esculentus*, sparse *Alcyonium digitatum* and grazing-tolerant fauna on moderately exposed circalittoral rock	
(MCR.As)	**Ascidian communities (silt-influenced)**	
StoPaur	*Stolonica socialis* and/or *Polyclinum aurantium* ascidian communities with *Flustra foliacea* on slightly sand-scoured tide-swept moderately exposed circalittoral rock	
(MCR.SfR)	**Soft rock communities**	
Pol	*Polydora* sp tubes on upward facing circalittoral soft rock	
CIRCALITTORAL MIXED SEDIMENTS (CMX)		
SspiMx	*Sabellaria spinulosa* and *Polydora* spp on stable circalittoral mixed sediment	Common
ModMx	*Modiolus modiolus* beds on circalittoral mixed sediment	Uncommon

Appendix IV Matrix of relative vulnerability

The relative vulnerability of an interest feature or sub-feature is determined by multiplying the scores for relative sensitivity and exposure, and classifying that total into categories of relative vulnerability.

		Relative sensitivity of the interest feature			
		High (3)	**Medium (2)**	**Low (1)**	**None detectable (0)**
Relative exposure of the interest feature	**High (3)**	**9**	**6**	**3**	**0**
	Medium (2)	**6**	**4**	**2**	**0**
	Low (1)	**3**	**2**	**1**	**0**
	None (0)	**0**	**0**	**0**	**0**

Categories of relative vulnerability

High	**6 - 9**
Medium	**3 - 5**
Low	**1 - 2**
None detectable	**0**

Appendix V English Nature's Habitats Regulations Guidance Note 1: The Appropriate Assessment (Regulation 48) The Conservation (Natural Habitats & c.) Regulations 1994